

## TRENDS IN INDIAN AGRICULTURAL RESEARCH: AN ANALYTICAL STUDY

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*Investigates the trends in Indian Agricultural research with regard to its various branches, the extent of research collaboration, institution-wise productivity, channels of communication used, rank of journals and the scholarship of papers basing the entries noticed in the Indian Science Abstracts (1976-78, 1980-83).*

ture, an upsurge in the research carried out becomes evident. This increasing research has resulted in the emergence of various trends. The identification of these trends is rendered possible by the application of bibliometric technique.

### OBJECTIVES

The purpose of the present study is to bring forth the research trends in the field of agriculture. In this approach, an attempt is made to identify:

- The subjectwise distribution of the articles
- Authorship pattern
- Institutionwise productivity of agricultural literature
- Bibliographic forms of materials
- Authors' preference to the journals for publication
- The core periodicals; to apply Brookes model to estimate the number of periodicals that could contribute at least one relevant paper to the subject.
- The scholarship of papers in the field.

### SOURCE JOURNAL

In the present study *Indian Science Abstracts* published by INSDOC was opted as the source journal, since it covers exhaustively the research work published in India and also the work done in India but published abroad. Necessary data for the study was collected from the journal between the periods, 1976-1983 excepting the literature published during 1979 because of its non-availability at the time of investigation.

### INTRODUCTION

Science is growing at a faster rate, activated or catalysed by an increase in research. This growth or progress is accompanied by a change in the trends of research followed. The change wrought down is neither dramatic nor sudden, rather remarkably gradual and no demarcation can be made. On the other hand, this change in the trends can be traced by generating numerical data on the basis of the empirical evidence available. In the process of identifying the research trends in a field, it is, essential to analyse the various patterns that are evident in the literature of the field. The literature of any field, emerging from the investigations or research carried out is the best indicator or exposé of the trends extant in the field, as these reflect with consistency and regularity the research trends. Thus, from the remarkable features possessed by the literature, it is possible to draw powerful conclusions.

Agriculture, the field chosen, in the present analysis, is the profession of nearly three-fourths of Indians. This necessitated an improvement in the tools and techniques employed in agriculture. Consequently, scores of research workers engaged themselves in improving agriculture. With an awareness of the importance of agricul-

## ANALYSIS

### *Subjectwise Break Up*

Agriculture, the basic science of human existence, has branched into various subfields, as a result of man's anxiety to explore the depth and vastness of the subject. This branching into narrow specialised fields was inevitable, because of the rapid growth and vast accumulation of the literature and a researcher's inability to cope with the flooding literature. Thus, agriculture, from its infant stage has developed through the ages and has branched into various subfields. Analysis of the literature, however, brings forth the trend that, of various subfields, research is more pronounced in the area of field crops, having 30.98% (6095) papers (Table 1). The next area is stock breeding, livestock, having 21.14% (4105) papers. The third place is claimed by agronomy, with papers accounting to 11.90% (2309). Table 1, a replica of the trends in the research front, clearly points out that the general field is being probed into deeply than most of the allied fields like fisheries, sericulture, etc.

Major output in the areas of field crops and stock breeding, accounting for 52% of the total output can be substantiated in the Indian context, considering that India is basically an agricultural country. Being an agricultural country, research is directed towards developing new techniques for improving the productivity of crops and cattle breeding.

### *Authorship Pattern*

The trend of specialization in various subject fields, has resulted in the exponential growth of literature. This is also due to the complex and heterogeneous nature of subjects. Thus most of the disciplines being characterised by these factors have encouraged collaborative research. The research literature in agricultural field too is embedded to this trend.

An analysis of the agricultural literature reveals that two-author papers top the list throughout the seven years covered, followed by three and one-author papers. In all 8733 (45.45%) two author papers were encountered, followed by

5056 (26.31%) three-author papers, and 3160 (16.43%) single author papers (Table 2 & 3).

More than 83.56% of the papers are having two or more authors, this clearly reflects the trend of multiple authorship. This fact is further substantiated by the table indicating 'Author per paper'. Author per paper being 1.41 during 1976, has gradually increased through the years and has reached 2.36 authors per paper by 1983. On this basis, it can be concluded that the trend is towards multiple authorship.

### *Institutionwise Analysis*

The agricultural scientists, engaged in research, belong to organisations like universities and colleges that can provide the conducive environment, essential for probing deeper. The environment includes the financial support, encouragement, equipment and tools, etc. A scientist seeks the organisation that can provide the necessary facilities for proceeding with research. It is, however, commonly noticed that the major output is from the universities followed by research institutions and colleges. An analysis of the data in agricultural sciences also reflects this trend. It can be observed from Table 4 that throughout the seven-year period the output from the universities secured the highest position accounting for 8837 papers (45.87%) of the total output. This finding is in consonance with the findings of the studies by Verma, et al[4] and Rangarajan and Gupta[3]. The output from the research and scientific institutions ranks second with an average of 6846 (35.54%) papers. The output of 2440 papers (12.67%) from the colleges, which claims the third place is very meagre in comparison to those from universities and research institutions (Table 4).

Thus, the analysis clearly indicates that the output from the universities and research institutions together constitute more than 81 per cent of the total output. This can be accounted for the furthering of research. Added to this there is the time factor. In the colleges, time that can be devoted for research is less. This also puts a check on the research in colleges.

### *Bibliographic forms of Materials*

Scientists communicate research results in a variety of channels. Of the various channels

*Table 1*  
*Subjectwise Distribution*

Sl. No.	UDC	Subjects	Number of papers							Cumulative Number	Cumulative Percentage
			1976	1977	1978	1980	1981	1982	1983		
1.	631	Agronomy	347	390	355	253	261	413	290	2309	11.81
2.	632	Plant diseases, injuries, pests, crop damage and protection	394	238	347	107	185	236	194	1701	20.5
3.	633	Field crops	683	960	1129	694	909	1020	700	6095	51.66
4.	634	Arboriculture	213	404	367	232	325	405	267	2213	62.98
5.	635	Horticulture	225	336	351	207	337	313	368	2137	73.90
6.	636	Stock breeding, Livestock	376	615	642	656	847	472	497	4105	94.89
7.	637	Dairy and other Animal produce	42	62	69	60	68	39	33	373	96.80
8.	638	Insect and reptile management, Breeding industries, etc.	26	24	31	7	46	31	26	191	97.77
9.	639	Game and fish management, Marine husbandry	36	94	60	30	43	80	92	435	100.00
Total			2342	3123	3351	2246	3021	3009	2467	19,559	100.00

Table 2

*Yearwise break up of Authorship Pattern*

Year	Number of Articles									Total
	1 Author	2 Authors	3 Authors	4 Authors	5 Authors	6 Authors	7 Authors	8 Authors	9 Authors	
1976	436	1042	552	195	37	11	1	-	1	2275
1977	507	1380	857	264	63	11	1	1	-	3094
1978	580	1492	872	298	54	19	3	-	-	3318
1980	269	987	647	202	56	19	3	1	-	2182
1981	440	1354	790	318	64	11	4	1	-	2982
1982	479	1462	728	259	47	15	2	-	-	2992
1983	449	1016	610	234	49	16	5	-	-	2379

Table 3

*Yearwise Distribution of Authorship Pattern (in %)*

Year	% Distribution of Articles					Author per paper
	1 Author	2 Authors	3 Authors	4 Authors	5 and more authors	
1976	19.16	45.80	24.26	8.57	2.20	1.41
1977	16.44	44.75	27.79	8.56	2.46	2.33
1978	17.48	44.97	26.28	8.98	2.29	2.34
1980	12.32	45.19	29.62	9.25	3.62	2.48
1981	14.77	45.41	10.66	2.68	3.08	26.49
1982	16.01	48.86	24.33	8.66	2.14	2.31
1983	18.88	42.68	25.65	9.84	2.94	2.36

Table 4

*Distribution of Articles from Various Institutions*

Sl. No.	Organisations	Number of Papers							Total	Percentage
		1976	1977	1978	1980	1981	1982	1983		
1.	Universities	972	1367	1552	970	1445	1431	1100	8837	45.87
2.	Research and Scientific Institutions	840	1140	1123	818	1057	988	880	6846	35.54
3.	Colleges	275	377	400	337	355	409	287	2440	12.67
4.	Unidentified	184	200	238	121	125	162	112	1142	5.93
Total		2271	3084	3313	2246	2982	2990	2379	19265	100.00

available, primary journals being a formal, regular and orderly channel form the basic medium as a carrier of information. Journals are also considered to be one of the means of wider and rapid communication of research results. Thus, a scientist by preferring a journal for the publication of his articles, is assured that the results of his investigation will be widely communicated among the fellow scientists. Such a wider and rapid communication also adds to the total exploitation of the scientific information effectively and efficiently. This trend of author's preference for publication in the journals is commonly observed in the field of agricultural science also.

Analysis of the literature of all the seven years indicates that, journal articles are the most highly available form of literature accounting for 18,891 (96.39%) out of the total 19,559 bibliographic items. This is followed by the standards (1.39%), and conference literature (1.1%) (Table 5).

*Ranking of Periodicals*

Above 96% of the literature covered in this study has been published in 294 journals. This indicates profusion of journal publications caused by the increase in research. The increase in research, and the consequent flooding of the literature,

necessitates the introduction of a new journal in a specialised branch or splitting of a journal in order to channelise research in a particular field and avoid scattering. This proliferation of journals has its repercussion on the budget and space of the library. The nonelastic financial resources of the library, therefore, demand the identification of the core journals, effectively covering the most significant literature of the subject, and thereby, making the acquisition extremely selective. The ranked list, prepared by the application of bibliometric techniques helps in the identification of the core journals in the field (Table 6).

*Indian Journal of Animal Science* tops the rank list with 1040 papers (5.51%), followed by *Indian Journal of Agric Science* with 1029 papers (5.48%), and *Indian Veterinary Journal* with 904 papers (4.79%).

Interdisciplinary nature of research has resulted in the scattering of literature of a particular subject in a number of periodicals. A graph prepared on the basis of Brookes model [1] to find out the number of periodicals contributing at least one relevant article related to the subject brought forth the fact that there were 8050 such periodicals in agricultural science (Fig.1).

Table 5

*Bibliographic Forms of Material*

Sl. No.	Forms of Material	Yearwise Distribution							Cumulative Number	Cumulative Percentage
		1976	1977	1978	1980	1981	1982	1983		
1.	Journal Articles	2271	3062	3246	2166	2977	2966	2203	18,891	96.58
2.	Standards	67	33	25	38	24	11	73	271	97.96
3.	Congress/Symposia/Seminars/Proceedings	-	19	-	17	-	20	157	213	99.04
4.	Patents	-	6	8	12	15	6	115	62	99.35
5.	Theses	4	3	5	13	5	4	18	52	99.61
6.	Monographs	-	-	1	-	-	-	1	2	99.67
7.	Reports	-	-	-	-	-	2	-	2	99.68
8.	Others	-	-	66	-	-	-	-	66	100.00
Total		2342	3123	3351	2246	3021	3009	2467	19,559	100.00

Table 6

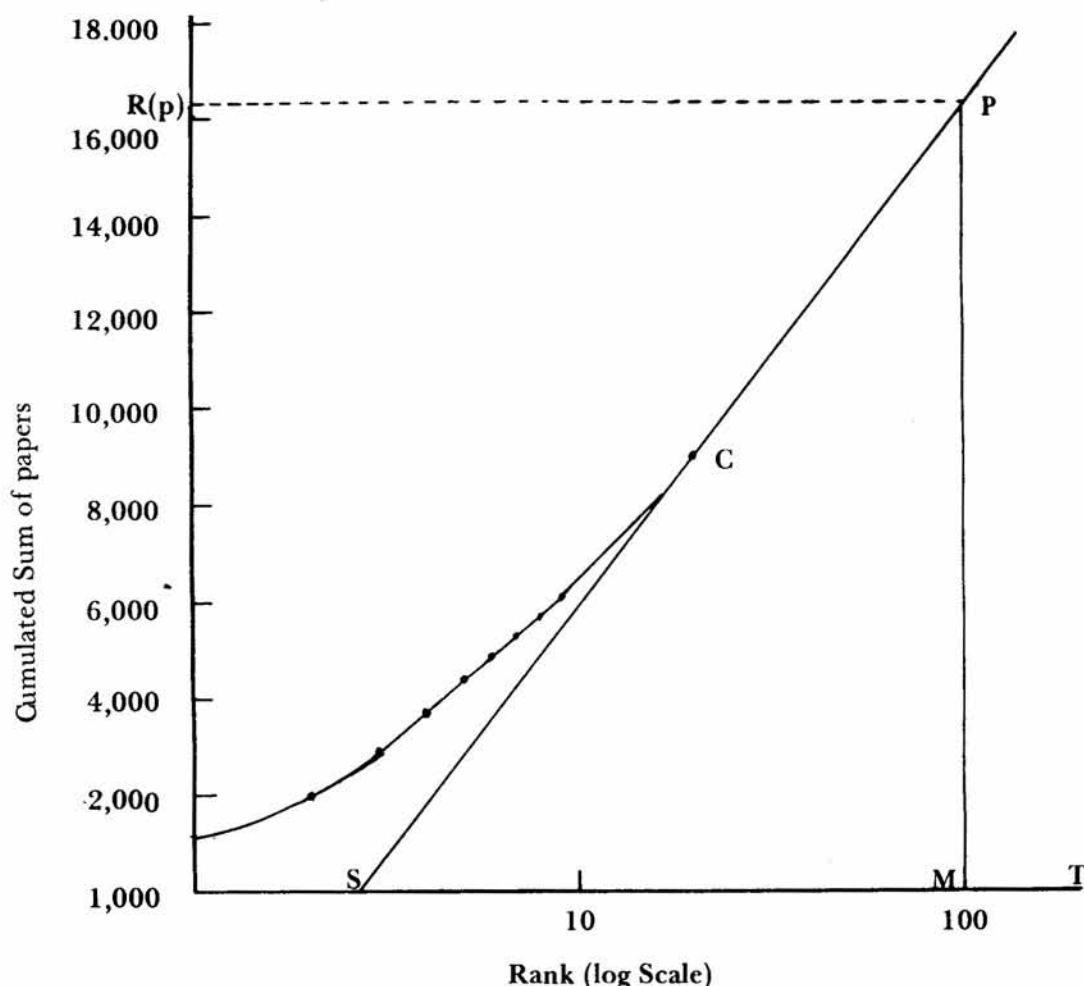
*Ranked List of Journals*

Sl. No.	Rank No.	Title of the periodical	Country	No. of papers	Cumulative number	Percentage	Cumulative percentage
1	2	3	4	5	6	7	8
1.	1	Indian J. Anim. Sci. (1931)	India	1040	1040	5.505	5.505
2.	2	Indian J. Agric. Sci. (1931)	India	1029	2069	5.447	10.952
3.	3	Indian Vet. J. (1924)	India	904	2873	4.785	15.737
4.	4	Current Science (1932)	India	827	3800	4.377	20.114
5.	5	Pesticides, Bombay (1967)	India	637	4437	3.371	23.485
6.	6	J. Indian Soc. Soil Sci. (1953)	India	557	4994	2.948	26.433
7.	7	Indian Phytopath (1968)	India	454	5448	2.403	28.836
8.	8	Indian J. Hort. (1944)	India	387	5835	2.048	30.884
9.	9	Sci. Cult. (1935)	India	368	6203	1.948	32.832
10.	10	J. Mah. Agric Univ. (1976)	India	329	6532	1.741	34.573
11.	11	Mysore J. Agric. Sci. (1967)	India	326	6858	1.704	36.277
12.	12	Madras Agric. J.	India	309	7167	1.636	37.913

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13.	13	J. Res. Ludhiana (1964)	India	297	7464	1.572	39.485
14.	14	Indian Forester (1875)	India	283	7747	1.498	40.983
15.	15	Livestock Advise (1967)	India	282	8029	1.492	42.475
16.	16	Indian Jagric Res. (1967)	India	272	8301	1.439	43.914
17.	17	Indian J. Agron. (1956)	India	268	8569	1.418	45.332
18.	18	Fd. Emg. Agri. (1980)	India	235	8804	1.243	46.575
19.	19	Indian Emg. (1951)	India	205	9009	1.085	47.660
20.	20	Progeve Hort. (1969)	India	204	9213	1.079	48.739
21.	21	Andhra Agric. J. (1954)	India	186	9399	0.984	49.723
22.	21	Indian J. Mycol. Pl. Path. (1971)	India	186	9585	0.984	50.707
23.	22	S. Indian Hort. (1971)	India	179	9764	0.947	51.654
24.	23	J. Nucl. Agric. Biol. (1972)	India	177	9941	0.937	52.591
25.	24	Indian Fmr. Dig. (1968)	India	172	10113	0.91	53.501
26.	25	Punjab Hort. J. (1961)	India	167	10280	0.884	54.385
27.	26	Kerala J. Vet. Sci. (1970)	India	166	10446	0.879	55.264
28.	27	Ann Arid Zone (1962)	India	165	10611	0.873	56.137
29.	28	Geobios (1974)	India	160	10771	0.847	56.984
30.	29	Poult. Advis (1968)	India	154	10925	0.815	57.799
31.	30	Pestology	India	151	11076	0.799	58.598
32.	31	Indian J. Exp. Biol. (1963)	India	149	11225	0.789	59.387
33.	31	Indian Sug. (1951)	India	149	11225	0.789	60.176
34.	32	Proc. Natn. Acad. Sci. India (1931)	India	137	11511	0.725	60.901
35.	33	J. Plantn. Crops (1973)	India	133	11644	0.703	61.604
36.	34	Cheiron, Madras (1972)	India	123	11767	0.651	62.255
37.	34	Gujarat Agric. Univ. Res. J. (1975)	India	123	11890	0.651	62.906
38.	35	Proc. Indian Natn. Sci. Acad. (1935)	India	121	12011	0.64	63.546
39.	36	Indian J. Genet. Pl. Breed (1941)	India	116	12127	0.614	64.16
40.	37	Indian Perfumer	India	111	12238	0.588	64.748
41.	37	Seed Res. (1973)	India	111	12349	0.588	65.336
42.	38	Indian Poult. Gaz. (1917)	India	110	12459	0.582	65.918
43.	39	Fertil. News (1956)	India	109	12568	0.577	66.495
44.	40	Indian J. Anim. Health (1962)	India	108	12676	0.572	67.067
45.	41	Agric. Res. J. Kerala (1963)	India	107	12783	0.566	67.633
46.	42	J. Fd. Sci. Technol. (1964)	India	106	12889	0.561	68.194
47.	43	Trans. Indian Soc. Desert Technol. (1976)	India	105	12994	0.556	68.75
48.	44	Haryana Vet. (1962)	India	103	13097	0.545	69.295
49.	44	Indian J. Agric. Chem. (1968)	India	103	13200	0.545	69.84
50.	45	Fmr. Parliam. (1966)	India	102	13302	0.54	70.38
51.	46	Lalbaugh (1956)	India	101	13403	0.535	70.915
163		Other Titles (Having Less Than 100 Articles)		5488	18891	29.039	99.954
214		Grand Total		18891		99.954	

SCALE - y axis - 0.5" = 2,000 papers



Graphical method of identifying the nuclear periodicals & estimating the number of periodicals contributing atleast one relevant article.

### *Bibliographic References*

A discipline develops by banking upon the available literature in the field. The published literature of any field provides a base for new research. The number of references provided by a paper are further considered as a gauge to assess the scholarly level or merit of a paper, because when an investigation rests on the exhaustive use or exploitation of the precious literature, that investigation can be considered as scholarly, having been based upon proved facts. Different methods or scales have been used by different scholars to measure the scholarly status of a

paper. A paper is considered scholarly by Price, provided it has more than ten references[2].

It is evident from the Table 7 that the field is flooded with papers having less than ten references. The ratio of the papers with less than ten references to those with more than ten is 76:24. It is further evident from the table that as the number of references per paper increases, there is a considerable decrease in the number of papers.

At this stage, when one proceeds to assess the scholarly merits of the papers in the field of agriculture, applying Price's method[2], it is found out that only one-fourth of the papers in



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Table 7

*Frequencies of Number of References per Paper Expressed as the Percentage of all Papers*

References per paper	Number of paper	Per cent of total papers	Cumulative Per cent of total papers
0	14,945	76.409	76.409
10	726	3.711	80.12
11	564	2.883	83.003
12	492	2.515	85.518
13	423	2.162	87.68
14	355	1.815	89.495
15	280	1.431	90.926
16	260	1.329	92.255
17	213	1.089	93.344
18	181	0.925	94.269
19	128	0.654	94.923
20	133	0.679	95.602
21	106	0.541	96.143
22	88	0.449	96.592
23	67	0.342	96.934
24	65	0.332	97.266
25	46	0.235	97.501
26	51	0.26	97.761
27	43	0.219	97.98
28	32	0.163	98.143
29	24	0.122	98.265
30	26	0.132	98.397
31-40	128	0.654	99.051
41-50	50	0.255	99.306
51-60	32	0.163	99.469
61-80	33	0.168	99.637
81-100	21	0.107	99.744
101-200	34	0.173	99.917
201-300	10	0.051	99.968
301-457	3	0.015	99.983

the field are scholarly and the rest are non-scholarly with less than ten references appended to them.

### CONCLUSION

Most of the patterns in the agricultural field discussed above conform to the general trend observed in most other healthy and growing disciplines.

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